REMARKS

In Applicants' previous response, claims 1-2 and 7-8 were amended and claim 21 was added. Claims 3-6 and 9-10 were cancelled. The claims currently pending in the present application are 1-2, 7-8, and 11-21. No amendments to the claims have been made in this response. Applicants respectfully request reconsideration of the present application in view of the Remarks herein.

35 U.S.C. § 103 REJECTIONS

Claims 1-2, 7-8, and 11-21 have been rejected as being unpatentable over Albrecht, et al. (U.S. Patent Nos. 5,798,425 or 6,777,517 B1) or WO 01/58579 in view of Yamashita, et al. (U.S. Patent No. 6,911,494 B2) or Yaguchi, et al. (U.S. Patent No. 6,762,220 B1), for the reasons of record set forth at pages 2-5 of the Office Action.

Claim 1 was previously amended to include the subject matter of original claim 6. Claim 1 is directed to a cement additive containing at least two copolymers, each of which comprise one or more constitutional units represented by formula A, one or more constitutional units represented by formula B, and one or more constitutional units represented by formula C. As previously amended, at least one of the copolymers of the cement additive is characterized by a mole ratio of constitutional units A and C of $0.1 \leq A/C \leq 1$ and a mole ratio of constitutional units B and C of $B/C \leq 1$, while the other copolymer is characterized by a mole ratio of constitutional units A and C of $A/C > 1$ and a mole ratio of constitutional units B and C of $1 < B/C \leq 20$.

The Albrecht '425 and '517 patents and WO 01/58579 in view of Yamashita, et al. or Yaguchi, et al. do not alone or in combination disclose or suggest a cement admixture containing copolymer mixtures with the claimed molar ratios of the constitutional units A, B and C, varying between at least two different copolymers in the mixture. Nor do they teach or suggest the unexpected results obtained by use of the claimed cement additive, having the

combination of copolymers. each with differing, distinct narrow ranges of the molar ratios of their constitutional units.

Contrary to the allegations of the Office Action, none of the cited documents teach or suggest, either alone or in combination, a cement additive comprising at least two copolymers with the specific molar proportions of constitutional units A, B and C as recited in Applicants' claim 1. In other words, none of the cited documents teach or suggest a cement additive comprising the combination of at least two copolymers wherein the mole ratio of the constitutional units A and C is $0.1 \leq A/C \leq 1$ and the mole ratio of the constitutional units B and C is $B/C \leq 1$ for at least one of the copolymers; and the mole ratio of the constitutional units A and C is $A/C > 1$ and the mole ratio of the constitutional units B and C is $1 < B/C \leq 20$ for the other copolymer.

First, neither Albrecht '425 nor '517 (nor either of them in combination with the cited secondary references) disclose the specific molar proportions of constitutional units, A. B and C as recited in Applicants' claim 1. Albrecht '425 and '517 both disclose the compositional amount of the structural units of their respective copolymers in terms of mole percent rather than as a specific molar ratio between the different components. Albrecht '425 and '517 both disclose copolymers comprising 1-89 mol % of the structural element A and 10-90 mol % of structural element B. Although the mole percentages disclosed in Albrecht '425 and '517 of structural elements A, B, and C may encompass the specific molar ratios between components A, B, and C of Applicants' claim 1, nothing is taught or suggested in these two references (or the secondary references) with respect to the desirability and advantages of selecting the specific, distinct and narrow molar ratios of the A, B and C constitutional units for at least two distinct copolymers recited in claim 1 as previously amended. Instead, all possible molar ratios of components within the mole percent ranges are taught as desireable, within a single copolymer.

It is alleged that Albrecht '425 discloses up to 50 mol % of unsaturated acrylic or methacrylic acid derivatives such as methyl methacrylate and hydroxycthyl methacrylate (See '425 Col. 5, Lines 30-42) encompassing the instant formula C. The Office Action also alleges

that '517 discloses up to 50 mol % of vinyl or unsaturated (meth)acrylic derivatives such as methyl methacrylate, (meth)acrylamide, methyl acrylate, and butyl acrylate (See '517 Col. 7. Lines 43-53). However, col. 5, lines 29-34 of Albrecht '425 states that the disclosed copolymer according to a preferred embodiment, additionally contains up to 50 mol % of monomers of vinyl, acrylic acid or methacrylic acid derivatives based on the sum of components a). b) and c) of Albrecht '425. In other words, the '425 copolymer may contain up to 50 mol % based on the total mol % of components a), b) and c) and not based on the total copolymer composition. Likewise, col. 7, lines 43-53 of Albrecht '517 states that the disclosed copolymer, according to a preferred embodiment, may further comprise up to 50 mol % of structures derived from monomers based on vinyl or (meth)acrylic acid derivatives based on the sum of structural units "a to d" of Albrecht '517 and not based on the total copolymer composition. The mole percent of Applicants' component C as recited in claim 1 however, is based on the total amount of the A, B, and C components of each of the multiple copolymers respectively, in the cement additive (See Specification as filed Page 5, Paragraph (15)) and must fit within the molar ratios with respect to components A and B as recited in claim 1.

Second, WO 01/58579 does not disclose the specific molar proportions of constitutional units, A, B and C as recited in Applicants' claim 1. WO 01/58579 defines the compositional amount of the polymer containing polyalkylene oxide groups of the dispersant composition in terms of a ratio between the number of anionic groups (selected from the group consisting of a carboxyl group, sulfonic acid group, phosphoric acid group, carboxylate group, sulfonate group and phosphate group - see WO 01/58579 abstract), and the number of cationic groups (selected from the group consisting of an amino group and an ammonium base - see WO 01/58579 abstract), without respect to the monomer containing the polyalkylene oxide group. WO 01/58579 does not teach or suggest a mole ratio between the different consititutional units as Applicants do in claim 1. Specifically, the compositional amount of the polyalkylene oxide monomer and the acid or anhydride monomers of claim 1 are defined with respect to the C monomer without regard to whether it is anionic or cationic. Page 20, lines 7-18 of WO/0158579 specifically states:

"The ratio of the number of anionic groups and the number of cationic

groups (anionic groups/cationic groups) contained in a monomer mixture used for obtaining "a polymer containing polyalkylene oxide groups", (contained in its monomer (A), monomer (B), and monomer (D) added, if necessary, and monomer (E) added, if necessary) is preferably set in the range of 30/70 to 99.5/0.5, more preferably, 50/50 to 99.5/0.5, and most preferably, 80/20 to 99/1.

Therefore, the amounts of monomer (A), monomer (B), monomer (D) added, if necessary, and monomer (E) further added, if necessary, are preferably set so as to satisfy such a ratio of the number of anionic groups and the number of cationic groups. Moreover, in the case when none of the monomer (D) and monomer (E) are used, the amounts of monomer (A) and monomer (B) are preferably set so as to satisfy the ratio of the number of anionic groups and cationic groups."

Finally, neither Yaguchi et al. (US 6.762,220) nor Yamashita et al. (6,911494) disclose the specific molar proportions of constitutional units, A, B and C as recited in Applicants' claim 1. Yaguchi et al. discloses a cement additive containing unsaturated polyalkylene glycol type copolymer and or the salts thereof and a polyalkylene glycol derivative. See Yaguchi et al. Col. 1, Lines 32-34. The amount of polycarboxylic acid type copolymers added to cement in Yaguchi et al. is 0.05-1.0% by weight based on the weight of cement, and the amount of the polyalkylene glycol derivative added to cement is 0.005-0.5% by weight based on the weight of cement. See Yaguchi et al. Col. 2, Line 65 to Col. 3, Line 3. Yaguchi et al. does not disclose the amount of polycarboxylic acid type copolymers and polyalkylene glycol derivatives in terms of specific molar ratios as in Applicants' claim 1. Even if it did, Yaguchi et al. fails to teach constitutional units A and C as claimed by Applicants in claim 1, as neither the unsaturated polyalkylene glycol type copolymer nor the polyalkylene glycol derivative meets the requirements for these constitutents of the at least two copolymers in the subject cement additives.

Yamashita et al. also does not disclose the specific molar proportions of constitutional units A, B and C as recited in Applicants' claim 1. Yamashita et al. discloses a cement

admixture comprising 1) a copolymer A; 2) an unsaturated (poly)alkylene glycol ether monomer; and 3) an unpolymerizable (poly)alkylene glycol wherein the content of the unsaturated (poly)alkylene glycol ether monomer is 1 to 100% by mass relative to copolymer A and the content of the unpolymerizable (poly)alkylene glycol is 1 to 50% by mass relative to copolymer A. See Yamashita et al. Col. 4, Lines 16-25. Neither the unsaturated (poly)alkylene glycol ether monomer nor the unpolymerizable (poly)alkylene glycol is described in terms of their specific molar ratios as claimed by Applicants in regard to the amounts of constitutional units A, B, and C in claim 1. Even if the unsaturated (poly)alkylene glycol ether monomer and the unpolymerizable (poly)alkylene glycol were described in terms of their specific molar ratios. Yamashita et al. fails to teach consititutional units A, B, and C as claimed by Applicants. as neither the unsaturated (poly)alkylene glycol ether monomer nor the unpolymerizable (poly)alkylene glycol meets the requirements for these constitutents of the at least two copolymers in the subject cement additives.

As discussed above, none of the cited references disclose copolymers having the specific molar ratios of constitutional units A, B, and C as claimed by Applicants in claim 1. Nor are there suggestions in any of the references as to the specific combinations of copolymers to use, or that it would be advantageous to combine such copolymers in a formulation to solve the problems of good dispersion, maintaining of slump and good workability. According to Section 2144.05 of the MPEP an Applicant may rebut a prima facie case of obviousness based on overlapping ranges by showing the criticality of the claimed range. Generally, an Applicant may show that a claimed range is critical by showing that the claimed range achieves unexpected results relative to the prior art range. *In re Woodruff*, 919 F.2d 1575 (Fed. Cir. 1990).

The Supreme Court has long held that secondary considerations such as commercial success, long felt but unsolved needs, failure of others, etc., may have relevancy as indicia of obviousness or nonobviousness. *Graham v. John Deere*. 393 U.S. 1. 17-18 (1966). MPEP 2141 states that such secondary considerations include unexpected results. Consideration of unexpected results for the purpose of determining obviousness has been affirmed by the Supreme Court in *KSR International Co. v. Teleflex Inc.* and has been articulated in MPEP

2143.01, which, quoting *KSR International Co. v. Teleflex Inc.*, states, "the mere fact that references can be combined or modified does not render the resultant combination obvious unless the results would have been predictable to one of ordinary skill in the art." *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385, 1396 (2007) ("If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.").

Page 5, paragraph (0015) - page 6, paragraph (0016) of the present Specification defines copolymers wherein the mole ratio of the constitutional units A and C is $0.1 \leq A/C \leq 1$ and the mole ratio of the constitutional units B and C is $B/C \leq 1$ as having characteristic slump retention properties while copolymers wherein the mole ratio of the constitutional units A and C is $A/C > 1$ and the mole ratio of the constitutional units B and C is $1 < B/C \leq 20$ as having characteristic dispersing properties. As stated in Paragraph (0020) of the present Specification, the present cement additive,

> based on the copolymer structure, the elements constituting said copolymers and the intramolecular ratios of the constitutional elements as well as on the **mixing ratios** of the specific copolymers by which these properties can be achieved, provides excellent working properties, dispersion properties and slump maintaining properties and achieves excellent working properties and workability for a wide range of concrete manufacturing conditions.

As shown in Table 4 of the present Specification, the claimed cement additive provides superior performance as compared to conventional additives. When mixed into concrete, the examples which utilized various cement additives as presently claimed, exhibited superior performance as compared to Comparative Example 1, in which the copolymers lacked constituent units of formula C, and as compared to Comparative Examples 2 and 3, which utilized a conventional polycarboxylic acid ether high performance AE water-reducing agent. Examples 3 and 5 received the best overall evaluation of "a" which was based on their separate

evaluations for changes in slump values (which were less than 3.0 cm), slump flow values (which were less than 5.0 cm), and changes in state of the concrete (which was based on differences in appearance and shape before and after slumping). The example 3 mixture, for instance, includes a combination of P6 polymer and P7 polymer (See Table 3), with P6 having an A/C monomer ratio of 1.0 and B/C monomer ratio of 1.0 and P7 having a A/C monomer ratio of 1.3 and a B/C monomer ratio of 2.8. These monomer ratio values for P6 and P7 are entirely consistent with claim 1 with P6 contributing as a slump maintaining agent and P7 contributing as a dispersing agent.

Likewise, Table 5 illustrates that Applicants' cement additive also achieved excellent dispersion properties. Examples 10 and 11 achieved the best dispersion with the shortest mixing time of 11 seconds. For instance, example 11, which includes mixture 7, includes a combination of P2 and P9 (See Table 3), with P2 having an A/C monomer ratio of 0.6 and a B/C monomer ratio of 0.9, and P9 having an A/C monomer ratio of 5.0 and a B/C monomer ratio of 6.0. These monomer ratio values for P2 and P9 are entirely consistent with claim 1 with P2 contributing as a slump maintaining agent and P9 contributing as a dispersing agent. Mixture 7's excellent slump maintaining properties is also evidenced by example 7 in Table 4 which received a slump difference value of "b" (3.0 cm or more but less than 6.0 cm), a slump flow difference of "a" (less than 3.0 cm), a change in state value of "a", and an overall evaluation of "b-a".

Albrecht '425 and '517 teach that the number of alkylene oxide repeating units within the oxyalkylene glycol alkenyl ether ranges from 0-100 and 0-200 respectively. See Albrecht '425 Col. 3, Lines 28-38 and Albrecht '517 Col. 5, Lines 28-37. Yamashita et al. teaches that the number of oxyalkylene group repeating units within its polyoxyalkylene glycol monomer is from 1 to 500 (See Yamashita et al. Page 2, Paragraphs [0014] – [0015], while Yaguchi et al. teaches that the number of alkylene oxide repeating units within its unsaturated polyalkylene glycol type monomer is on average from 1 to 100 (See Yaguchi et al. Col. 1, Lines 47-65). The present application claims that the number of alkylene oxide repeating units of constitutional unit A ranges from 6 to 25. (See claim 1 wherein $6 \leq m_1 + m_2 \leq 25$).

The alkylene oxide chain within constitutional unit A has an influence on the dispersion properties of the copolymer composition. The most preferred dispersion properties are obtained when $m_1 + m_2$ from S_1 and S_2 of the alkylene oxide chain in constitutional unit A is 6 to 25. See Specification as Filed, Page 12, Paragraph (31). By selecting alkylene oxide repeating units of such narrow and discrete ranges, Applicants were able to obtain superior dispersion properties. See Specification, Page 20, Table 5.

The present claims, therefore, define a cement additive containing at least two copolymers, each copolymer having at least one type of three different formulae constituent units, the copolymers having different mole ratios between the three constituent unit types, the combination of which advantageously provides both slump maintenance and dispersing effects.

Even within the two disparate copolymers as claimed, constitutional unit A is used to incorporate an alkylene oxide chain or a similar structure into the copolymer structure, and mainly has an influence on dispersion properties (See Specification as Filed, Page 12, Paragraph 31). Constitutional unit B having a suitable structure and incorporated at a specific amount into the copolymer, provides excellent slump maintaining properties (See Specification as Filed Page 12, Paragraph 33).

Constitutional unit C has the role of maintaining the cement composition in a good state. This constitutional unit, which plays a role in achieving excellent workability, keeps the cement and the aggregates well blended and maintains an appropriate degree of viscosity and flow properties even if the water/cement ratio in the cement composition and the temperature change and time passes (See Specification as Filed, Page 12, Paragraph 34).

Furthermore, Albrecht '425 and '517 (and therefore their combination with the secondary references) both teach away from Applicants' mole ratios of claim 1. First, Albrecht '425 discloses that its copolymer preferably consists of 40-55 mol % monomers alleged to be comparable to Applicants' structural unit A, 40-55 mol % monomers alleged to be comparable to Applicants' structural unit B, and up to 20 mol % referred to the sum of

components a), b), and c) of the monomer alleged to be comparable to Applicants' structural unit C. A calculation of the mole ratios A/C and B/C based on these mole percentages reveals that the Albrecht '425 values of A/C and B/C are well outside the mole ratios $0.1 \leq A/C \leq 1$ and $B/C \leq 1$ of claim 1. See Albrecht '425 Col. 5, Lines 25-34.

Second, Albrecht '517 discloses that the copolymer preferably comprises 19.5-39.5 mol % of the monomer alleged to be comparable to Applicants' structural unit A, 55-75 mol % of the monomer alleged to be comparable to Applicants' structural unit B, and preferably, up to 20 mol % based on the sum of structural units "a to d" of the monomer alleged to be comparable to Applicants' structural unit C. A calculation of the mole ratio A/C and B/C based on these mole percentages, reveals that the mole ratio A/C in Albrecht '517 is well outside the mole ratio $0.1 \leq A/C \leq 1$ of claim 1 while the mole ratio B/C in Albrecht '517 is well outside the mole ratio $B/C \leq 1$ of claim 1. See Albrecht '517 Col. 7, Lines 37-53.

Therefore, a person skilled in the art would not be motivated to attempt the claimed combinations of units and copolymers in the claimed proportions without reference to the subject Specification, disclosing the mixtures of copolymers and specifying the ratios of A, B and C as claimed that have an effect as dispersion agent, slump retainer and at the same time keeping the cement composition in a good state of workability. Based on the arguments set forth above, Applicants respectfully request that the 35 U.S.C. §103(a) rejection of claim 1 be withdrawn. Applicants further request that the 35 U.S.C. §103(a) rejection of claims 2, 7-8, and 11-21, which depend on and include the limitations of claim 1, be withdrawn as well.

The Office Action alleges that the cement additive species of claims 8, 12, and 14-16 are conventionally included in cement compositions, as taught in the '494 and '220 patents, and one having skill in the art would have readily envisaged their inclusion, thus rendering these claims obvious. However, as MPEP §2143.03 states, "[i]f an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988)." See MPEP at §2100-142. It is noted that claims 8, 12 and 14-16 all depend, either directly or indirectly, from claim 1.

Therefore, in view of the amendments and remarks above, Applicants respectfully request withdrawal of the 35 U.S.C. §103 rejection with respect to claims 1-2, 7-8, and 11-21.

In view of the amendments and remarks contained above, Applicants respectfully request reconsideration of the application, withdrawal of the 35 USC §103 rejections, and request that a Formal Notice of Allowance be issued for claims 1-2, 7-8, and 11-21. Should the Examiner have any questions about the above remarks, the undersigned attorney would welcome a telephone call.

Respectfully submitted,

Joseph V. Curatolo, Esq. (Reg. No. 28,837)
Peter R. Detorre, Esq. (Reg. No. 61,801)
Curatolo Sidoti Co., LPA
24500 Center Ridge Road, Suite 280
Cleveland, OH 44145
Customer No. 23575 Telephone: 440.808.0011
Facsimile: 440.808.0657
Attorneys for Applicants

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